Claims

1. A thrust converter comprising:

reciprocating movement means;

reciprocation-rotation conversion means for converting reciprocating movement of the reciprocation movement means into rotational movement;

rotation-reciprocation conversion means for converting rotational movement of the reciprocation-rotation conversion means into reciprocating movement; and

reaction-force receiving means for supporting reaction force of reciprocating movement of the rotation-reciprocation conversion means.

2. The thrust converter according to claim 1, wherein the reciprocation movement means, the reciprocation-rotation conversion means, the rotation-reciprocation conversion means, and the reaction-force receiving means are aligned in one line; and a through hole is formed to pass through the center axes thereof.

3. The thrust converter according to claim 1 or 2, wherein the reciprocation-rotation converter means comprises a first screw member to which axial thrust is imparted by the reciprocation movement means, a second screw member to be

screw-engaged with the first screw member, and a first detent section for locking the first screw member to restrict movement to only an axial direction;

the rotation-reciprocation conversion means comprises a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member, a third screw member to be screw-engaged with the screw section, and a second detent section for locking the third screw member to restrict movement to only an axial direction; and

the reaction-force receiving means comprises a substrate, the second screw member, and a first shaft bearing for supporting the second screw member on the substrate to allow rotation and to prohibit axial movement.

4. The thrust converter according to claim 3, wherein the first screw member is supported by the reciprocation movement means by way of a second shaft bearing to be rotatable.

5. The thrust converter according to any one of claims 1 to 4, wherein the reciprocation movement means comprises a motor, and motor rotation-reciprocation conversion means for converting rotating movement of a shaft of the motor into reciprocating movement.

6. The thrust converter according to claim 1 or 2, wherein the reciprocation movement means comprises a motor, a fourth screw member provided on a load-side extremity of a shaft of the motor, a fifth screw member to be screw-engaged with the fourth screw member, a third detent section for locking the fifth screw member to restrict movement to only an axial direction, and motor rotation-reciprocation conversion means for converting the rotating movement of the shaft of the motor into reciprocating movement;

the reciprocation-rotation conversion means comprises a first screw member supported by the fifth screw member to allow rotation and to prohibit axial movement by way of a second shaft bearing, a second screw member to be screw-engaged with the first screw member, and a first detent section for locking the first screw member to restrict movement to only the axial direction;

the rotation-reciprocation conversion means comprises a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member, a third screw member to be screw-engaged with the screw section, and a second detent section for locking the third screw member to restrict movement to only an axial direction; and

the reaction-force receiving means comprises a substrate, the second screw member, and a first shaft bearing for

supporting the second screw member on the substrate to allow rotation and to prohibit axial movement.

7. The thrust converter according to any one of claims 3 to 6, wherein the second detent section for locking the third screw member to restrict movement to only an axial direction is interposed between the third screw member and a first screw member.

8. The thrust converter according to any one of claims 3 to 7, wherein screw lead of the first screw member and screw lead of a second screw member to be screw-engaged with the first screw member are greater than screw lead of a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member and greater than screw lead of a third screw member to be screw-engaged with the screw section.

9. The thrust converter according to any one of claims 3 to 7, wherein screw lead of the first screw member and screw lead of a second screw member to be screw-engaged with the first screw member are smaller than screw lead of a screw section provided on the second screw member in a position different from the location of a screw section to be screw-engaged with the first screw member and smaller than screw lead of a third

screw member to be screw-engaged with the screw section.

10. The thrust converter according to any one of claims 3 to 9, wherein a screw lead angle between a screw section which is formed on the second screw member in a location different from that of a screw section to be screw-engaged with the first screw member and a third screw member to be screw-engaged with the screw section is taken as β and a coefficient of friction of a screw is taken as μ, a screw is formed to meet a relationship $\tan\beta < \mu$.

11. The thrust converter according to any one of claims 3 to 10, wherein a main spindle shaft of a chucking apparatus corresponding to the substrate is secured to a mount frame fixed to a load-side bracket of a motor by way of a third bearing to be rotatable and not to be capable of axial movement.

12. The thrust converter according to any one of claims 4 to 11, wherein the second bearing is constituted of a double bearing.

13. A method of controlling the thrust converter as defined in claim 5 or 6, wherein a motor whose torque can be controlled through current control is used as the motor, and constant thrust is produced by constant control of the current

to the motor.

14. A method of controlling the thrust converter as defined in claim 5 or 6, wherein a motor whose torque and positions can be controlled through current control is used as the motor; and wherein the position of the motor is controlled until the motor moves to a predetermined position, and torque of the motor is controlled.

15. A method of controlling the thrust converter as defined in claim 5 or 6, wherein the position or torque of a motor of the thrust converter is corrected on the basis of a moving status of an external drive source other than a drive source of the thrust converter.

16. A method of controlling the thrust converter as defined in claim 5 or 6, wherein the position of a motor of the thrust converter is corrected on the basis of the temperature of a machine having the thrust converter provided thereon.

17. A controller for controlling the thrust converter defined in claim 5 or 6, comprising:

an input section for entering a moving status of an external drive source other than a drive source of the thrust

converter;

computation means for computing the amount of correction used for correcting the position or torque of a motor of the thrust converter on the basis of the moving status entered by way of the input section; and

correction means for correcting the position or torque of the motor of the thrust converter on the basis of the computed amount of correction.

18. A controller for controlling the thrust converter as defined in claim 5 or 6, comprising:

an input section for entering the temperature of a machine having provided thereon the thrust converter;

means for computing the amount of correction required for correcting the position of a motor of the thrust converter or reading the amount of correction from memory; and

correction means for correcting the position of the motor of the thrust converter in accordance with the amount of correction.

19. A controller for controlling the thrust converter as defined in claim 5 or 6, comprising:

a manual instruction device for inputting a positional instruction to a motor whose torque and position can be controlled;

control means for controlling the position and torque of the motor; and

changeover means for which operates the motor through position control on the basis of a difference when a difference between the positional instruction and the current position is lower than a predetermined value and changes the motor to torque control when the difference between the positional instruction and the current position exceeds the predetermined value.

20. A controller for controlling the thrust converter as defined in claim 19, wherein the changeover means comprises:

current limit means for limiting a current instruction to be sent to the motor; and

means which sets a limit current value of the current limit means so as to become greater than a current instruction value based on a difference when a difference between the positional instruction and the current position is lower than a predetermined value and which sets the limit current value of the current limit means so as to become smaller than the current instruction value based on a difference when a difference between the positional instruction and the current position exceeds the predetermined value.

21. A controller for controlling the thrust converter

as defined in claim 5 or 6, comprising:

an input section for entering a correction value to be used for correcting a mechanical positional error of the thrust converter;

storage means for storing the correction value entered by way of the input means; and

correction means for correcting the mechanical positional error of the thrust converter on the basis of the correction value stored in the storage means.